

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1

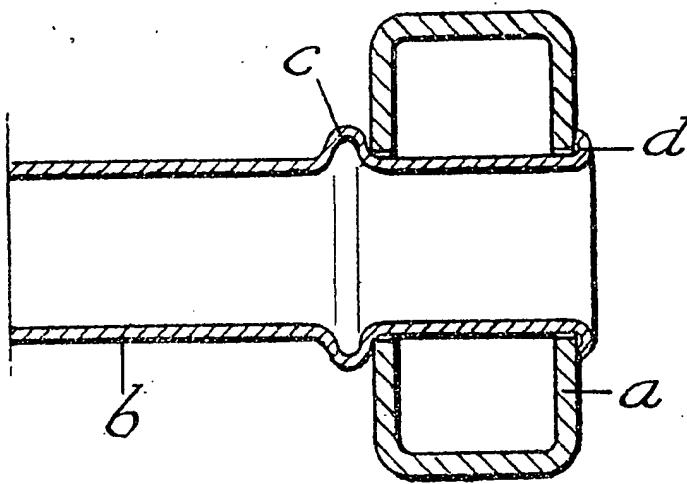
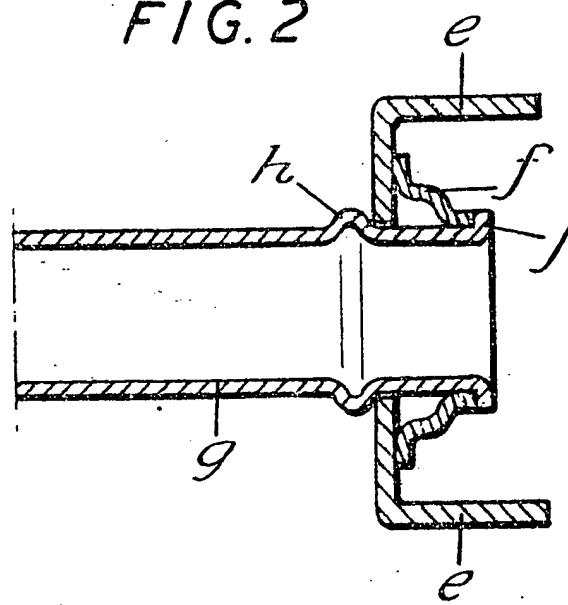


FIG. 2



# PATENT SPECIFICATION

587,952



Application Date: Sept. 16, 1944. No. 17752/44.

Complete Specification Left: Jan. 19, 1946.

Complete Specification Accepted: May 9, 1947.

## PROVISIONAL SPECIFICATION

### Improvements in or relating to Ladders

We, GRAVITY LADDERS LIMITED, a British Company, of 28, Pickford Street, Birmingham, 5, and CHARLES HAROLD BACH, a British Subject, of the Company's address, do hereby declare the nature of this invention to be as follows —

This invention relates to improvements in ladders and is particularly concerned with the attachment of tubular metal 10 rungs to the sides of an all-metal ladder.

One of the objects of our invention is to provide a form of attachment which is simple and inexpensive to produce and positively prevents any axial movement of 15 the rung relative to the side of the ladder.

According to our invention a tubular metal rung is attached to the side of a metal ladder by forming a shoulder on the rung adjacent its end by a swaging or 20 equivalent operation, passing the end of the rung through an opening in the ladder side and expanding the extremity of the rung outside the ladder side. Thus the rung is effectively located against axial 25 movement in the ladder side which is located between the shoulder on the rung and the expanded extremity of the rung and an extremely strong and rigid structure

produced with a minimum of labour and material. 30

The rung may be attached directly to the ladder side if the metal of the side is of substantial thickness but if the side is of channel section with a web of relatively small thickness a sheet metal pressing 35 having an apertured central domed part to receive the rung may be riveted or otherwise secured to the web to increase the effective length of the bearing of the rung in the ladder side. 40

In one practical construction a shoulder may be formed on the tubular rung by enlarging the tube at the required point to form an annular projecting rib. This rib may be formed by rolling the wall of the 45 tube between an internal convex roller and an external concave roller, or the tube may be upset under axial pressure to form the rib.

Our invention is applicable to any metal 50 ladders but is particularly applicable to ladders made of aluminium or light alloy.

Dated the 2nd day of September, 1944.  
BARKER, BRETTELL AND DUNCAN  
Chartered Patent Agents,  
75 & 77, Colmore Row, Birmingham, 3.

## COMPLETE SPECIFICATION

### Improvements in or relating to Ladders

We, GRAVITY LADDERS LIMITED, a British Company, of 28, Pickford Street, Birmingham, 5, and CHARLES HAROLD BACH, a British subject, of the Company's address, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the 60 following statement:—

This invention relates to improvements in ladders and is particularly concerned with the attachment of tubular metal rungs 65 to the sides of an all-metal ladder.

One of the objects of our invention is to provide a form of attachment which is simple and inexpensive to produce and positively prevents any axial movement of 70 the rung relative to the side of the ladder.

According to our invention a metal rung

tube of uniform diameter throughout its length is locally expanded by a swaging or equivalent operation to produce adjacent its end an outwardly projecting and complete or uninterrupted annular rib without reducing the end of the rung, and the unreduced end portion of the rung is passed through an opening in the ladder side until the annular rib makes all-round abutment 80 against the inner face of the side, whereupon the extremity of the rung end portion which projects beyond the ladder side is expanded to form an outwardly projecting annular retaining flange. Thus the run is 85 effectively secured against axial movement in the ladder side which is located between the annular rib on the rung and the outwardly flanged extremity of the rung, and an extremely strong and rigid structure 90

[Price 1/-]

Price 4s 6d

Folio 11

is produced with a minimum of labour and material and without reducing or shoulder ing down the end portion of the rung tube.

The rung may be attached directly to 5 the ladder side if the metal of the side is of substantial thickness but if the side is of channel section with a web of relatively small thickness a sheet metal pressing having an apertured central domed part 10 to receive the rung may be rivetted or otherwise secured to the outer side of the web to increase the effective length of the bearing of the rung in the ladder side.

Some practical methods of securing a 15 tubular metal rung to a ladder side in accordance with our invention are illustrated by way of example in the accompanying drawings in which :—

Figure 1 is a fragmentary section of a 20 ladder side of flattened tubular section and of a rung secured in it.

Figure 2 is a similar section showing the attachment of a rung to a side of channel section.

25 In the construction shown in Figure 1 *a* is a ladder side formed by a metal tube of rectangular cross-section. The rung *b* is formed from a metal tube of uniform circular cross-section and its end is received 30 in a circular opening in the side. To locate and secure the rung an uninterrupted or complete annular projecting rib *c* is formed in it to bear against the inner face of the side and the free end of the rung is flanged 35 over outwardly on the outer face of the side as shown at *d*. The outwardly projecting rib *c* may be formed by rolling the wall of the tube between an internal convex roller and an external concave roller, or the tube 40 may be upset under axial pressure to form the rib.

In the construction shown in Figure 2 the 45 ladder side *e* is of channel section with a web of relatively small thickness, and to increase the effective length of the bearing for the rung a sheet metal pressing *f* having an apertured central domed part is rivetted or otherwise secured to the web of the channel.

50 The rung *g* which has an annular rib *h* is passed through registering apertures in the web of the channel and in the pressing and its end is expanded by flanging over as shown at *j*.

55 Our invention is applicable to any metal ladders but is particularly applicable to ladders made of aluminium or light alloy.

We are aware of Patent Specification No. 384,935 which describes a construction 60 of ladder with tubular sides and rungs, the

latter being of circular or oval section with reduced end portions which are passed through apertures in the sides and have their projecting extremities clinched over on the outsides to secure the rungs in 65 position.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim 70 is :—

1. A method of securing a tubular metal rung in the side of a metal ladder which consists in locally expanding a metal rung tube of uniform diameter throughout 75 its length by a swaging or equivalent operation to produce adjacent its end an outwardly projecting and complete or uninterrupted annular rib without reducing the end of the rung, passing the unreduced 80 end portion of the rung through an opening in the ladder side until the annular rib makes all-round abutment against the inner face of the ladder side, and then expanding the extremity of the rung end portion which 85 projects beyond the ladder side to form an outwardly projecting annular retaining flange.

2. A method of securing a tubular metal rung in the side of a metal ladder as claimed 90 in Claim 1 in which the projecting annular rib is produced by upsetting the tube under axial pressure or by rolling the wall of the tube between an internal convex roller and an external concave roller.

3. A method of securing a tubular metal rung in the side of a metal ladder as claimed 95 in either of the preceding claims, in which the effective length of the bearing of the rung in the ladder side is increased by 100 securing to the latter a sheet metal pressing having an apertured central domed part to receive the rung end portion projecting beyond the outer face of the ladder side.

4. A metal ladder having tubular rungs 105 secured in the sides by the method claimed in any of the preceding claims.

5. The method of securing a tubular metal rung in a metal ladder side substantially as described with reference to the 110 accompanying drawings.

6. A metal ladder having tubular rungs secured in the sides by the method substantially as described with reference to the accompanying drawings.

115

Dated the 16th day of January, 1946.  
BARKER, BRETELL & DUNCAN,  
Chartered Patent Agents,  
75 & 77, Colmore Row, Birmingham, 3.